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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/842,714      | 04/27/2001  | Eun-Hwa Hong         | 030681-297          | 7444             |

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EXAMINER  
LISH, PETER J

ART UNIT PAPER NUMBER  
1754

DATE MAILED: 03/18/2003

10

Please find below and/or attached an Office communication concerning this application or proceeding.

| <b>Office Action Summary</b> | <b>Application No.</b>          | <b>Applicant(s)</b>     |
|------------------------------|---------------------------------|-------------------------|
|                              | 09/842,714                      | HONG ET AL.             |
|                              | <b>Examiner</b><br>Peter J Lish | <b>Art Unit</b><br>1754 |
|                              |                                 |                         |

The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM

**A SHORTENED STATUTORY PERIOD FOR REPLY  
THE MAILING DATE OF THIS COMMUNICATION.**

**THE MAILING DATE OF THIS COMMUNICATION.** Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication. If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely. If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication. Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

## **Disposition of Claims**

4)  Claim(s) 1-27 is/are pending in the application.  
4a) Of the above claim(s) 16-24 and 26 is/are withdrawn from consideration.  
5)  Claim(s) \_\_\_\_\_ is/are allowed.  
6)  Claim(s) 1-15, 25 and 27 is/are rejected.  
7)  Claim(s) \_\_\_\_\_ is/are objected to.  
8)  Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

9)  The specification is objected to by the Examiner.

10)  The drawing(s) filed on \_\_\_\_\_ is/are: a)  accepted or b)  objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)  The proposed drawing correction filed on \_\_\_\_\_ is: a)  approved b)  disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)  The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)  All b)  Some \* c)  None of:

1.  Certified copies of the priority documents have been received.
2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3.  Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

14)  Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a)  The translation of the foreign language provisional application has been received.

15)  Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

1)  Notice of References Cited (PTO-892)  
2)  Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3)  Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_

4)  Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_

5)  Notice of Informal Patent Application (PTO-152)

6)  Other: \_\_\_\_\_

Application/Control Number: 09/842,714  
Art Unit: 1754

### DETAILED ACTION

Applicant's arguments with respect to claims 1-15 and 24 have been considered but are moot in view of the new ground(s) of rejection. Additionally, regarding applicant's arguments that claim 24 be examined as a linking claim, it is noted that due to the changes made in the claim by amendment C, claim 24 is no longer considered to be in proper form to be identified as a linking claim. Accordingly, claim 24 has not further been treated on its merits. Claim 26 is drawn toward the invention of Group II, which was non-elected. Accordingly, claim 26 has not further been treated on its merits.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

### *Claim Rejections - 35 USC § 102*

Claims 1, 2, 5, 7-10, 25, and 27 are rejected under 35 U.S.C. 102(b) as being anticipated by Tennent et al. (USPN 5,165,909).

Tennent teaches a method of producing carbon nanotubes which comprises contacting a suitable carbon-containing gaseous compound with suitable metal-containing particles at elevated temperatures. The surface of the metal-containing particle may be independently heated to a temperature higher than the gaseous compound by electromagnetic radiation (column 4, lines 45-50).

Tennent also discloses that the metal particles may contain a variety of transition metals, including iron, cobalt, or nickel, or an alloy or mixture thereof. Furthermore, the metal particles may be precipitated as metal oxides, hydroxides, carbonates, or other metal salts that thermally

Application/Control Number: 09/842,714  
Art Unit: 1754

decompose to metallic particles (column 8, lines 3-10, 17-40). Additionally, in order to grow fibrils, or nanotubes, throughout the entire reactor volume, the metallic particles may be formed by thermolysis of a metal-containing vapor, such as ferrocene, in the reactor itself (column 8, lines 50-60).

Tennent also teaches that suitable carbon-containing gases include benzene, methane, acetylene, and propane. He teaches that diluents such as argon, and inert gas, or compounds capable of reaction with carbon to produce gaseous products, such as hydrogen gas may be present (column 7, lines 36-65).

*Claim Rejections - 35 USC § 103*

Claims 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tennent et al.

Tennent et al. is applied above. Tennent et al. teach the use of electromagnetic radiation as a means for independently heating the catalyst material. Tennent et al. do not explicitly teach the use of microwave heating, electromagnetic induction heating, laser heating, or RF heating. However, official notice is taken by the examiner that these are all known means of supplying electromagnetic radiation, and thus it would have been obvious to one of ordinary skill at the time of invention to use any of these means in order to independently heat the metal materials, as taught by Tennent et al.

Claims 3-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tennent et al. as applied to claim 1 above, and further in view of Mandeville et al (USPN 6,423,288). Tennet

Application/Control Number: 09/842,714

Art Unit: 1754

does not disclose the means by which the catalyst will be loaded onto the support. However, in a process of forming carbon fibrils (MWNTs) through Chemical Vapor Deposition on a transition metal catalyst, Mandeville et al teach various methods of loading the catalyst. "The transition metal may be deposited on the substrate by any commonly used technique for accomplishing such deposition. Vapor deposition, sputtering, and impregnation may all be suitable" (column 4, lines 33-36). Precipitating the metal onto the support by evaporating an aqueous or organic medium is also disclosed (column 4, lines 36-49).

It thus would have been obvious to one of ordinary skill at the time of invention to perform the loading of the catalyst onto the support or substrate by impregnation, incipient wetness, deposition, spraying, etc, as taught by Mandeville et al., in the nanotube production process of Tennent et al in order to provide an effective catalyst.

Claims 6 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tennent et al. as applied to claim 1 above and further in view of Kambe et al. (USPN 6,045,769). Tennent neither teaches the use of hydrogen sulfide gas in the carbon-containing gas, nor in converting the metal particles to metal sulfides. Kambe, however, in a process of forming carbon fibrils through chemical vapor deposition, teaches that the reactant stream can include other reactants such as hydrogen gas or hydrogen sulfide (column 10, lines 63-65). Thus it would have been obvious to one of ordinary skill at the time of invention to use a hydrogen sulfide diluents, as taught by Kambe, in the process of Tennent.

Kambe et al. also disclose a means of catalyst production whereas an iron precursor is reacted with "preferred second reactants serving as a sulfur source, including for example

hydrogen sulfide gas" (column 3, lines 61-62). Thus it would have been obvious to one of ordinary skill at the time of the invention to use hydrogen sulfide gas to form a metal sulfide for use as a catalyst in the process of Tennent et al. in order to provide an effective catalyst.

Claims 12-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tennent et al. as applied to claim 1 above, and further in view of Margrave et al (PGPub US 2002/0004028 A1).

Tennent et al. do not explicitly teach the use of microwave heating, electromagnetic induction heating, laser heating, or RF heating. Margrave et al. teach a method of independently heating the catalyst material for growing carbon nanotubes. Margrave et al. teach that the heat focused at the catalyst material may be supplied by laser, microwave energy, or RF energy (page 16, paragraph 0184). It would have been obvious to one of ordinary skill at the time of invention to use any of these means of supplying localized electromagnetic radiation in the process of Tennent et al. in order to independently heat the catalyst material.

#### Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Lish whose telephone number is 703-308-1772. The examiner can normally be reached on 9:00-6:00 Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 703-308-3837. The fax phone numbers for the

Application/Control Number: 09/842,714

Art Unit: 1754

organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-305-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

PL

March 13, 2003



STUART L. HENDRICKSON  
PRIMARY EXAMINER